Rule CIC303: Log stream structure offloads occurred: 90% full

Finding: The SMF Type 88 data showed that log stream structure offloads occurred because the structure was 90% full. This finding applies only to log streams that are defined to use a coupling facility structure.

Impact: This finding has a MEDIUM IMPACT or HIGH IMPACT on the performance of the CICS region.

Logic flow: This is a basic finding, based on an analysis of the SMF Type 88 system logger data. The finding applies only with CICS/Transaction Server for OS/390.

Discussion: The CICS Log Manager is a domain that was introduced with CICS/Transaction Server for OS/390. The CICS Log Manager replaces the journal control management function of earlier releases of CICS.

Please refer to Rule CIC301 for more general information about the interaction between CICS and the MVS system logger.

Data in a log stream is contained in two kinds of storage: (1) *interim storage*, where data can be accessed quickly without incurring DASD I/O, and (2) *DASD log data set storage*, where data is "hardened" for longer term access. When the interim storage medium for a log stream reaches a user-defined threshold, the log data is offloaded to DASD log data sets.

There are two types of log streams: coupling facility log streams and DASD-only log streams. The main difference between the two types of log streams is the storage medium system logger uses to hold interim log data:

- In a coupling facility log stream, interim storage is contained in coupling facility list structures.

- In a DASD-only log stream, interim storage is contained in local storage buffers on the system, as an MVS data space areas associated with the system logger address space.

Interim storage normally is "offloaded" to DASD log data sets based on two parameters associated with each log stream: the HIGHOFFLOAD and LOWOFFLOAD parameters. The values for these parameters are

expressed as a percent of the interim storage[1] being filled. For log streams defined in coupling facility list structures, these parameters apply as follows:

- When the coupling facility structure is filled to the **HIGHOFFLOAD threshold** point or beyond, the system logger begins offloading data from the coupling facility to the DASD log stream data sets. For example, if the HIGHOFFLOAD parameter is specified as 80% (this is the default value), the system logger normally would begin offloading interim storage to DASD log data sets when 80% or more of the structure is used.

- The **LOWOFFLOAD threshold** is the point in the coupling facility structure, as a percent of space consumed, where the system logger stops offloading log stream data to DASD log data sets. The default LOWOFFLOAD parameter value is 0%, indicating that the system logger will offload all the log stream to DASD log data sets once offloading has commenced.

From the above description, the amount of data that normally is offloaded is the difference between HIGHOFFLOAD and LOWOFFLOAD, as percentages of the coupling facility list structure size. For example, if the HIGHOFFLOAD value was specified as 80% and LOWOFFLOAD value was specified as 60%, 20% (80%-60%=20%) of the structure would be offloaded once offloading commenced.

The word “normally” has been used deliberately in the previous paragraphs. There are some situations when HIGHLOFFLOAD and LOWOFFLOAD parameters do not control the system logger offloading process.

When a coupling facility structure is defined, it is divided into two areas: One area holds *list elements*, and the other area holds *list entries*. List elements are units of logged data and are either 256 bytes or 512 bytes long. There is at least one element per log record. List entries are index pointers to the list elements. There is one list entry per log record.

Each log record places an entry in the list entry area of the structure, and the data is loaded as one or more elements in the list element area. **If the list entry area exceeds 90% of its capacity, all log streams are offloaded to DASD.** DASD offloading commences at this point, regardless of the current utilization of the log stream, and continues until an amount of data equal to the difference between the HIGHOFFLOAD threshold and the LOWOFFLOAD threshold for the log stream has been offloaded.

[1] The controls apply **only** to staging data set usage with DASD-only log streams. Wtih coupling facility log streams, the controls apply to both couploing facility structure usage and staging data set usage if the log stream is duplexed to staging data sets.

This situation can occur when log steams share a structure, one log stream is used by an application issuing very few journal write requests, and other applications issue frequent journal write requests to log streams in the same structure. All log streams may be offloaded to DASD because of the frequent journal write requests by the other applications.

The primary disadvantage of encountering this situation is that the application that is infrequently writing to the log stream might not have its LOWOFFLOAD and HIGHOFFLOAD thresholds controlling the offload process. This can result in unpredictable offloading, and possibly undesirable performance.

For example, Log Stream A might have a HIGHOFFLOAD threshold of 80% and a LOWOFFLOAD threshold of 60%. Because of log stream activity by other applications writing to other log streams, the list entry area may exceed 90% of its capacity even though Log Stream A might be only 50% utilized. Although Log Stream A had not reached its HIGHOFFLOAD threshold, or even its LOWOFFLOAD threshold, data would be offloaded until 20% of the log stream was offloaded. This is the difference between 80% and 60%. After the offloading operation has completed, log stream A is at 30% utilization (50% minus 20%).

The MVS system logger writes SMF Type 88 records containing statistics for each connected log stream. This information is available as MXG TYPE88 file. Since the SMF Type 88 records are from a system view, the records do not contain information related to individual CICS regions.

The SMF Type 88 records do identify the structures and log streams to which the information applies. Consequently, CPExpert can use the CICS interval statistics to identify specific structures and log streams that apply to specific CICS regions. CPExpert can then select information from the SMF Type 88 records that describe the structures and log streams used by the particular CICS region.

CPExpert examines the SMF88STN variable (the structure name) to select information that applies only to coupling facility structures[2].

For these records, CPExpert examines the SMF88EFS variable (offloads for all log streams connected from this system to this structure because structure was 90% full) in the SMF Type 88 records. CPExpert produces Rule CIC303 when the SMF88EFS value exceeds the **STFULL90** guidance variable in USOURCE(CICGUIDE). The default value for the **STFULL90** is zero. Any non-zero value in the SMF88EFS variable indicates that the entry to element ratio is too high for the structure.

[2]The SMF88STN variable will be *DASDONLY* for log streams that are DASD-only log streams.

This problem occurs primarily when more than one log stream uses a coupling facility structure and the applications using the log streams write a significantly different rates. Consequently, the offloads are being triggered by all the entries being used rather than triggered by the HIGHOFFLOAD value.

Suggestion: When Rule CIC303 is produced, you should consider the following alternatives:

- Review the log streams that share the coupling facility structure. IBM recommends that log streams sharing a coupling facility structure have similar rates of writing and similar amounts of data written.
- Review the size of the list structure in the coupling facility, to determine whether the structure size should be increased.
- You can alter CPExpert's analysis by modifying the STFULL90 guidance variable in USOURCE(CICGUIDE).

Reference: *CICS/TS Release 1.1 Performance Guide*: Section 4.6.4 (LOWOFFLOAD and HIGHOFFLOAD parameters on log stream definition).

CICS/TS Release 1.2 Performance Guide: Section 4.6.5 (LOWOFFLOAD and HIGHOFFLOAD parameters on log stream definition).

CICS/TS Release 1.3 Performance Guide: Section 4.10.2 (Monitoring the logger environment).

CICS/TS for z/OS Release 2.1 *Performance Guide*: Chapter 22 (LOWOFFLOAD and HIGHOFFLOAD parameters on log stream definition).

OS/390 *MVS Setting up a Sysplex*:

OS/390 (V2R8): Section 9.4.3 (Determine the size of each coupling facility structure)
OS/390 (V2R9): Section 9.4.3 (Determine the size of each coupling facility structure)
OS/390 (V2R10): Section 9.4.3 (Determine the size of each coupling facility structure)

z/OS *MVS Setting up a Sysplex*:

Z/OS (V1R1): Section 9.4.3 (Determine the size of each coupling facility structure)
Z/OS (V1R2): Section 9.4.3 (Determine the size of each coupling facility structure)
Z/OS (V1R3): Section 9.4.3 (Determine the size of each coupling facility structure)
Z/OS (V1R4): Section 9.4.3 (Determine the size of each coupling facility structure)

